

**Method for producing a three-dimensionally formed armoring
component for vehicle bodies**

Patent Claims

1. A method for producing a three-dimensionally formed armoring component for vehicle bodies by the production of sheet metal preforms from hardenable steel, with the thermal pre-treatment of these steel sheet blanks, the heating speed and heating temperature being selected at least until the austenitic or partly austenitic state dependent on alloy content is reached, and with subsequent press forming and, if appropriate, subsequent hardness or heat treatment of the formed armoring components, **characterized in that** the hot forming and quench hardening of the steel sheet blanks are carried out in one operation, in that the austenitized steel sheet blank is formed by means of a press die within a time of at most 90 seconds, in that the formed component is held in full-area contact with the press die, in that the cooling of the formed component takes place in the closed press die, and in that the cooling of the formed component in the closed press die takes place at a cooling rate which corresponds at least to the material-specific critical cooling rate.

2. A method for producing a three-dimensionally formed armoring component for vehicle bodies by the production of sheet metal preforms from hardenable steel, with thermal pre-treatment of these steel sheet blanks, the heating speed and heating temperature being selected at least until the austenitic or partly austenitic state dependent on alloy content is reached, and with subsequent press forming and, if appropriate, subsequent hardness or heat treatment of the formed armoring components, **characterized in that** the hot forming and quench hardening of the steel sheet blanks are carried out in one operation, in that the austenitized steel sheet blank is formed by means of a press die still in the austenitic or partly austenitic state, in that the formed

1 component is held in full-area contact with the press die, in
2 that the press die is cooled at least to approximately 70°C
3 before the forming process, and in that, after the forming
4 process, the further cooling of the formed steel sheet blank
5 takes place without calibration, but with the pressing force
6 being maintained, for the purpose of heat dissipation from the
7 sheet blank in the press die.

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9 3. The method for producing a three-dimensionally formed
10 armoring component for vehicle bodies as claimed in one of
11 claims 1 and 2, characterized in that the steel sheet blanks
12 used are sheets of hardenable and maraging steels.

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14 4. The method for producing a three-dimensionally formed
15 armoring component for vehicle bodies as claimed in one of
16 claims 2 and 3, characterized in that steels with an initial
17 hardness of the armoring steel during hardening in hardening
18 oil higher than 45 HRC or with a hardness after artificial
19 ageing higher than 45 HRC are used.

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21 5. The method for producing a three-dimensionally formed
22 armoring component for vehicle bodies as claimed in one of
23 claims 1 to 4, characterized in that, during heating to the
24 austenitizing temperature, the alloying elements are dissolved
25 predominantly in the austenite.

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27 6. The method for producing a three-dimensionally formed
28 armoring component for vehicle bodies as claimed in one of
29 claims 1 to 5, characterized in that the heat treatment time
30 and temperature for austenitization are selected as a function
31 of the component material and material thickness in order to
32 minimize scaling, skin decarburization and grain growth.

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34 7. The method for producing a three-dimensionally formed
35 armoring component for vehicle bodies as claimed in one of
36 claims 1 to 6, characterized in that the forming of the
37 austenitized steel sheet blank takes place approximately at

1 the austenitizing temperature dependent on alloy content or at
2 temperatures at which the steel sheet blank is in the partly
3 austenitized state.

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5 8. The method for producing a three-dimensionally formed
6 armoring component for vehicle bodies as claimed in one of
7 claims 1 and 3 to 7, characterized in that, after the forming
8 operation, the press die is held closed for a period of time
9 of at least 50 to 500 seconds in order to achieve the desired
10 cooling temperature.

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12 9. The method for producing a three-dimensionally formed
13 armoring component for vehicle bodies as claimed in one of
14 claims 1 to 8, characterized in that the press die can be
15 cooled by coolants, preferably water, ammonia and/or
16 compressed air.

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18 10. The method for producing a three-dimensionally formed
19 armoring component for vehicle bodies as claimed in one of
20 claims 1 to 9, characterized in that the cooled and formed
21 steel sheet blanks are subjected to a final heat treatment in
22 the form of expansion and/or tempering.

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24 11. The method for producing a three-dimensionally formed
25 armoring component for vehicle bodies as claimed in one of
26 claims 1 to 9, characterized in that the cooled and formed
27 steel sheet blanks are finally retreated by tempering,
28 hardening and tempering, age hardening or artificial ageing.